

Development and Validation of Global Basins Database in Asia-Pacific Region(GBDB-AP)

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Global drainage basins data can be used in a broad range of Earth system science studies, including investigations of regional and global hydrology, climate, biogeochemistry, and ecosystem dynamics. The global drainage basins data derived from a global 1-km digital elevation model (DEM) has been developed by U. S. Geological Survey as one data of HYDRO1k database. However, the reliability of the drainage basins data of HYDRO1k database is questionable, because their validation of the drainage basins data with the existing rivers and basins data has not been enough. For example, comparing the drainage basins data of HYDRO1k database with the rivers data of Vector Map Level 0(VMAP0) which is one of the most reliable global rivers data, we could find many discrepancies between them. It is clearly necessary to develop more accurate and reliable global basins data.

We have developed the global basins database in Asia-Pacific (GBDB-AP). GBDB-AP includes the drainage basins data which consists of polygons of catchments which are subdivisions of basins into elementary drainage areas. Each polygon of a basin is identified by a Pfafstetter code and is attributed with geographic, topographic, and social information. The river channels data, the 1-km gridded flow direction data, and the 1-km gridded flow accumulation data, which are consistent with the drainage basins data of GBDB-AP, were also generated. All the generated data could be used not only in hydrological studies but also in other fields related to hydrological cycle at regional and continental scale.

The drainage basins data and the others were generated with DEMs modified by “stream burning” method. For regions except Japan and Korean Peninsula, we used the hydrologically corrected 1-km DEM distributed from HYDRO1k database and the rivers and lakes data of VMAP0 in “stream burning” procedure. For Japan and Korean Peninsula, we used a 100-m DEM and a 3-sec DEM respectively and they were modified by the rivers and lakes data available at Japan and Korea Peninsula. The “burned” DEMs of Japan and Korean Peninsula were further modified by the basin boundaries data available at each region.

We had two comparisons as a validation of the drainage basins data of GBDB-AP. Firstly, the drainage basins data of GBDB-AP was geographically compared with the digital drainage basin maps and the paper ones. The results of the comparison shows that almost all of the drainage basins data of GBDB-AP were in good geographical agreement with those maps. Secondly, we compared the calculated upstream areas with the reported ones for each gauging station provided by the Global Runoff Data Centre. The coefficient of determination R^2 between them was 0.99. Same comparisons were applied to the drainage basins data of HYDRO1k Database. The results of these comparisons revealed that GBDB-AP provides a more accurate and reliable drainage basins data than HYDRO1k database.